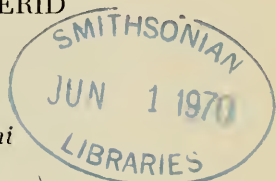


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PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

BIOLOGICAL INVESTIGATIONS OF THE DEEP SEA.
53. NEW SPECIES AND GENERA OF GONIASTERID
SEA STARS¹

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Two new species of goniasterid sea stars were collected in the tropical Atlantic by the R/V *Pillsbury* and R/V *Gerda* of the Institute of Marine Sciences, University of Miami. They are the type-species of new genera. The R/V *Pillsbury* also collected the second known specimen of *Plinthaster productus* A. H. Clark. This species does not belong in the genus *Plinthaster* and is made the type-species of a new genus.

The type-species of *Aphroditaster*, *A. gracilis* Sladen, belongs in the genus *Pseudarchaster*, making *Aphroditaster* invalid. A new genus is erected to accomodate *Aphroditaster microceramus* Fisher.

This research was supported by National Science Foundation grant GB-4936. The operations of the R/V *Gerda* and R/V *Pillsbury* were supported by National Science Foundation grant GB-7082. The field work was part of the National Geographic Society-University of Miami Deep-Sea Biology Program. The author is grateful to these agencies.

KEY TO THE GENERA DISCUSSED IN THIS PAPER

- 1. Unpaired median spine at apex of each mouth plate pair 2
- Pair of median spines at apex of each mouth plate pair 3
- 2. Adambulacral furrow margin straight *Fisheraster* new genus
- Adambulacral furrow margin angular *Pseudarchaster*
- 3. Abactinal plates completely covered by granules 4
- Abactinal plates not completely covered by granules 6

¹Contribution No. 1181 from the Institute of Marine Sciences, University of Miami.

4. Adambulacral granulation very crowded; plate not visible — *Peltaster*
 Adambulacral granulation spaced; plates visible between sub-
 ambulacral granules 5
5. Irregular secondary abactinal plates present; abactinals covered
 only by spherical granules *Pillsburiaster* new genus
 No secondary abactinal plates; peripheral granules of radial
 abactinals angular *Ceramaster*
6. All abactinal plates surrounded by single row of granules; naked
 area bearing glassy bosses *Plinthaster*
 Some abactinal plates bearing more than single row of granules;
 naked areas smooth 7
7. Radial plates mainly naked. General form stellate; more than six
 supermarginals in contact medially *Diplasiaster* new genus
 Radial plates having only small naked area. General form pentagonal;
 less than three supermarginals in contact medially
 *Apollonaster* new genus

Fisheraster new genus

Diagnosis: Unpaired (but not recurved) median spine at apex of each mouth plate pair. No spines or spinules on actinal and inferomarginal plates. Adambulacral furrow margin straight.

Remarks: This genus belongs in the subfamily *Pseudarchasterinae* but it is closer to the *Goniasterinae* than any of the known genera of this subfamily.

Type-species: *Aphroditaster microceramus* Fisher.

Etymology: This genus is named after Walter K. Fisher, who described the type-species and was an excellent asteroid systematist.

Fisheraster microceramus (Fisher, 1913)

Aphroditaster microceramus Fisher, 1913, pp. 626–627; 1919, pp. 225–228, pl. 59, fig. 1, pl. 91, fig. 1.

Remarks: This species is well described and illustrated by Fisher (1919). Plate 70, figure 5 is not a photograph of *Fisheraster microceramus*, but of the type of *Paragonaster stenostichus*.

Type: U.S. National Museum cat. no. 30535.

Type-locality: Buton Strait, Celebes, 05°35'S, 122°20'E, 1023 m, Albatross sta. 5648.

Distribution: This species is known only from the type-locality.

Pillsburiaster new genus

Diagnosis: Abactinal plates tabulate, completely covered by spherical granules; loosely arranged into primary and secondary plates in radial area and center of disk. Papulae irregularly distributed between primary and secondary abactinal plates. Subambulacral spines very small, not crowded.

Remarks: The abactinal surface in this genus is similar to that of the species of *Peltaster*, but the secondary plates are not as regularly arranged and are not clearly delineated from the primary plates. The peripheral granules of the radial plates are not different from the central granules, as they are in *Ceramaster*. The actinal surface is similar to that of *Plinthaster* and *Ceramaster*.

This genus belongs in the subfamily Goniasterinae. It appears to be intermediate to *Ceramaster* and *Peltaster*.

Pentagonaster ernesti Ludwig, 1905, from the tropical eastern Pacific, belongs in this genus.

Type-species: *Pillsburiaster geographicus* new genus, new species.

Etymology: *Pillsbury*—after the R/V *John Elliot Pillsbury* of the Institute of Marine Sciences, University of Miami. Many species of sea stars new to science have been collected on this ship's expeditions; *aster*, Greek—a common ending for genera of sea stars.

***Pillsburiaster geographicus* new genus, new species**

Figures 1, 2 (top)

Material studied: Holotype: R = 75 mm, r = 30 mm, R/r = 2.8; 04°36'N, 09°46'W, 1464–1556 m, R/V *Pillsbury* sta. 76, 4 June 1964, USNM E11258.—Paratypes: same location as holotype, 2 spec., USNM E11259.—03°50'N, 02°33'W, 1949–1986 m, R/V *Pillsbury* sta. 34, 29 May 1964, 1 spec., UMMML 40.240.

Diagnosis: Abactinal granules coarse, spherical. Five or six adambulacral furrow spines. Ten or eleven mouth furrow spines.

Description: Five arms. R = 75 mm, r = 30 mm, R/r = 2.8. General form stellate.

Abactinal plates loosely arranged into primary and secondary plates in long, narrow radial areas and small center of disk. Primary plates only two to four times as large as secondary plates; secondary plates loosely arranged between primary plates. Abactinal plates tabulate, irregularly round; completely covered by very closely crowded, coarse, spherical granules. Many abactinal plates bearing two or three valved, spatulate sugar-tong pedicellariae with short, wide, thick jaws.

Papulae in center of disk and radial areas; papular pores irregularly distributed, each containing single papula.

Superomarginal and inferomarginal plates corresponding; thirty-two plates in each series. Lateral angle of marginals depressed; plates mainly in horizontal plane. Marginals more angular on distal third of arm.

Superomarginals slightly wider than long. In interbrachial arc, lower half of each plate completely covered by granules similar to those on abactinals. Upper half bordered by two to three rows of similar granules; center bare or with one to three scattered granules. Naked area becoming larger distally, so that last six plates surrounded by single row of granules. Last three or four pairs of superomarginals contiguous medially. Terminal plate moderately large; in shape of truncated cone

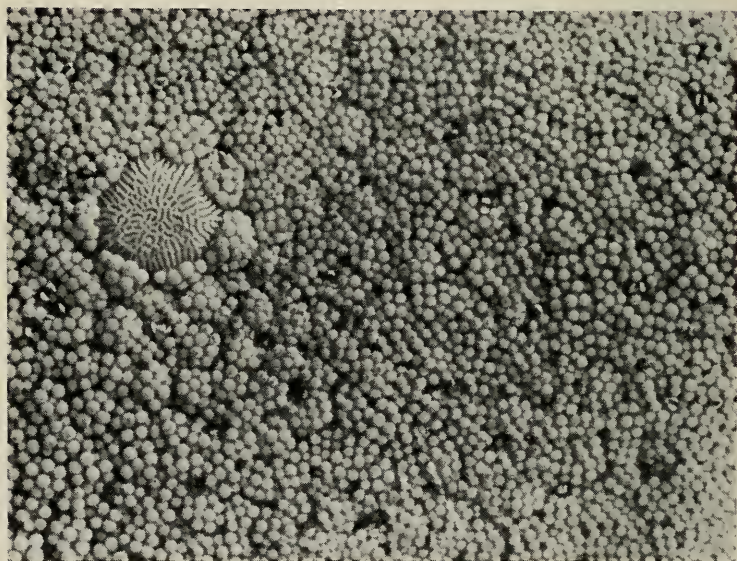
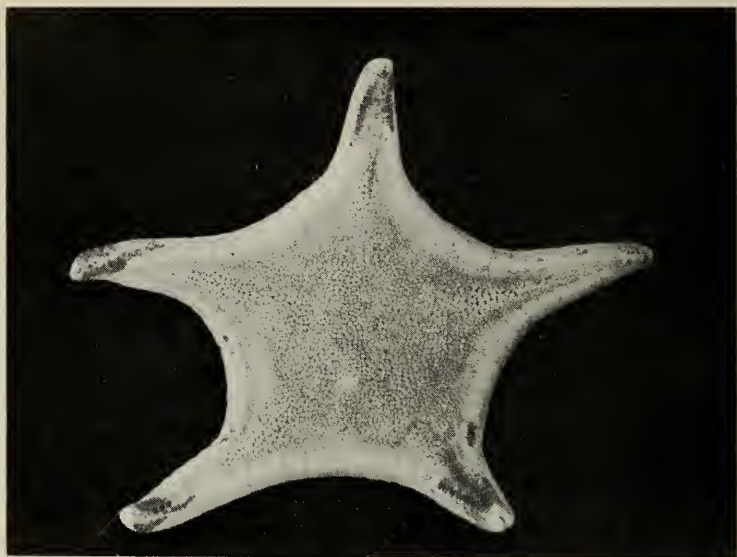


FIG. 1. *Pillsburiaster geographicus* new genus, new species, holotype: top, abactinal view, 0.8 \times .—bottom, abactinal view, 4.8 \times .

with apical depression bearing one large, short, wide, conical spine.

Inferomarginal plates slightly wider than long; completely covered by granules similar to those of superomarginals.

Actinal plates moderately large, rhombic; extending about half way down arms. Each plate completely covered by coarse, rounded granules similar to those on inferomarginals.

Adambulacral plates approximately square with straight furrow margin bearing five or six short, subequal, compressed furrow spines. Three to four irregular rows of four to six very short, blunt subambulacral spinules, slightly taller than actinal granules. Many adambulacral plates bearing two or three valved, spatulate sugar-tong pedicellariae, similar to abactinal pedicellariae but not as thick.

Each mouth plate bearing ten or eleven furrow spines; first nine or ten spines subequal, slightly taller and thicker than adambulacral furrow spines. Median spine more strongly compressed and slightly taller than other mouth furrow spines. Rest of each mouth plate completely covered by 22–24 large, rounded granules, about twice as large as actinal granules.

Madreporite irregularly round, about five times as large as adjacent abactinal plates; located approximately one-third distance from center of disk to middle of interbrachial arc.

Type: United States National Museum, cat. no. E11258.

Type-locality: Gulf of Guinea, off Cape Palmas, 04°36'N, 09°46'W, 1464–1556 m, R/V *Pillsbury* sta. 76.

Distribution: This species is known from only two localities in the northern Gulf of Guinea; off Cape Three Points, 1949–1986 m and off Cape Palmas, 1464–1556 m.

Discussion: Various characters of the paratypes are as follows:

<i>Pillsbury</i> station	R (mm)	r (mm)	R/r	Marginals	superomarginals in contact	adamb. furrow spines	mouth furrow spines
34	66	27	2.4	26	0–1	5–6	11–12
76	80	32	2.5	34	2–4	5–6	10
76	65	28	2.3	26	0–1	6	11

In the specimen measuring R = 80 mm, some of the superomarginals in the middle of the interbrachial arc are completely covered by granules.

Remarks: This species is very similar to *Pillsburiaster ernesti* and differs from it by having actinal pedicellariae and less stout subambulacral granules.

Etymology: *geographicus*—in reference to the National Geographic Society whose grant to the Institute of Marine Sciences, University of Miami for investigations of the deep-sea fauna helped make possible the discovery of many sea stars new to science.

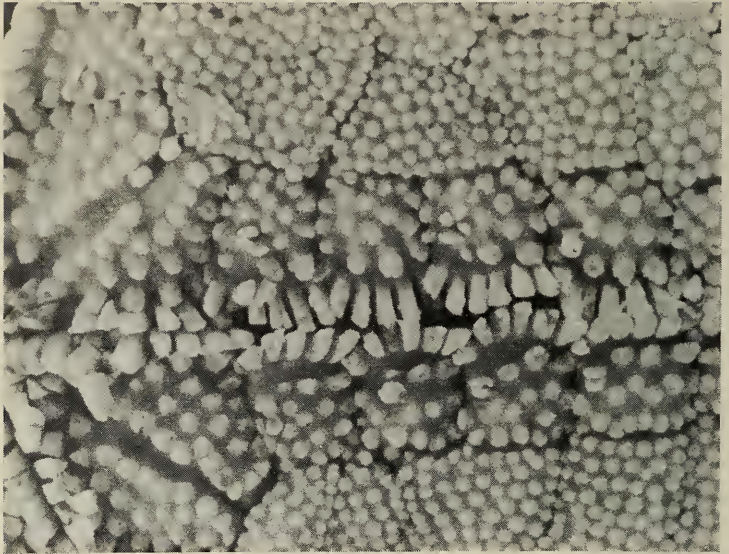


FIG. 2. Top, *Pillsburiaster geographicus* new genus, new species, holotype, actinal view, $6.8\times$.—bottom, *Diplasiaster productus* (A. H. Clark), specimen from R/V Pillsbury sta. 707, abactinal view, $2.9\times$.

Diplasiaster new genus

Diagnosis: Abactinal plates low-tabulate; surrounded by double row of granules in radial areas, single row elsewhere; no bosses. Superomarginals contiguous medially throughout length of arm. General form stellate.

Etymology: *Diplasios*, Greek—double; *aster*—a common ending for genera of sea stars; in reference to the double row of granules on the radial abactinal plates.

Remarks: This genus belongs in the subfamily Goniasterinae. It appears to be most closely related to *Apollonaster*. It differs from *Plinthaster* in the shape and granulation of its abactinal plates and in the large number of superomarginal plates in contact.

Type-species: *Plinthaster productus* A. H. Clark.

Diplasiaster productus (A. H. Clark, 1917)

Figures 2 (bottom) and 3

Plinthaster productus A. H. Clark, 1917. pp. 67–69; 1954, p. 375.

Material studied: Holotype: R = 27 mm, r = 12 mm, R/r = 2.3; 23°10'N, 82°23'W, 567 m, *Albatross* sta. 2154, 30 April 1884, USNM 36930.—11°22'N, 62°22'W, 78 m, R/V *Pillsbury* sta. 707, 19 July 1968, UMML 40.235.

Diagnosis: Four or five adambulacral furrow spines. Each mouth plate bearing eight furrow spines.

Description: Five arms. R = 29 mm, r = 13 mm; R/r = 2.2.

General form stellate, with broad, flat disk and narrow, strongly tapered arms. Interbrachial arcs wide, rounded.

Abactinal plates low-tabulate, restricted to disk. Plates smooth, naked in center; surrounded by single row of flattened granules except in radial areas, where some plates bearing second row of rounded granules inside peripheral row.

Twenty superomarginal plates naked except for one peripheral row of granules similar to those surrounding abactinals and U-shaped cluster of rounded granules adjacent to inferomarginals. Seven or eight pairs of superomarginals in contact medially. Terminal plate small, oval, surmounted by short spine. Twenty inferomarginal plates corresponding with superomarginals. Inferomarginals surrounded by two rows of rounded granules. Rest of each plate naked except for small area adjacent to superomarginals covered by closely crowded, rounded granules.

Actinal plates large, rhombic, completely covered by moderately large, rounded granules.

Adambulacral plates about half as big as adjacent actinals. Adambulacrals rectangular (about twice as wide as long) with straight furrow margin bearing four or five short, subequal, cylindrical furrow spines with rounded tips. First subambulacral row of two or three large, conical spines. Three to six rounded granules similar to those of actinals, in one or two irregular rows, covering rest of plate.

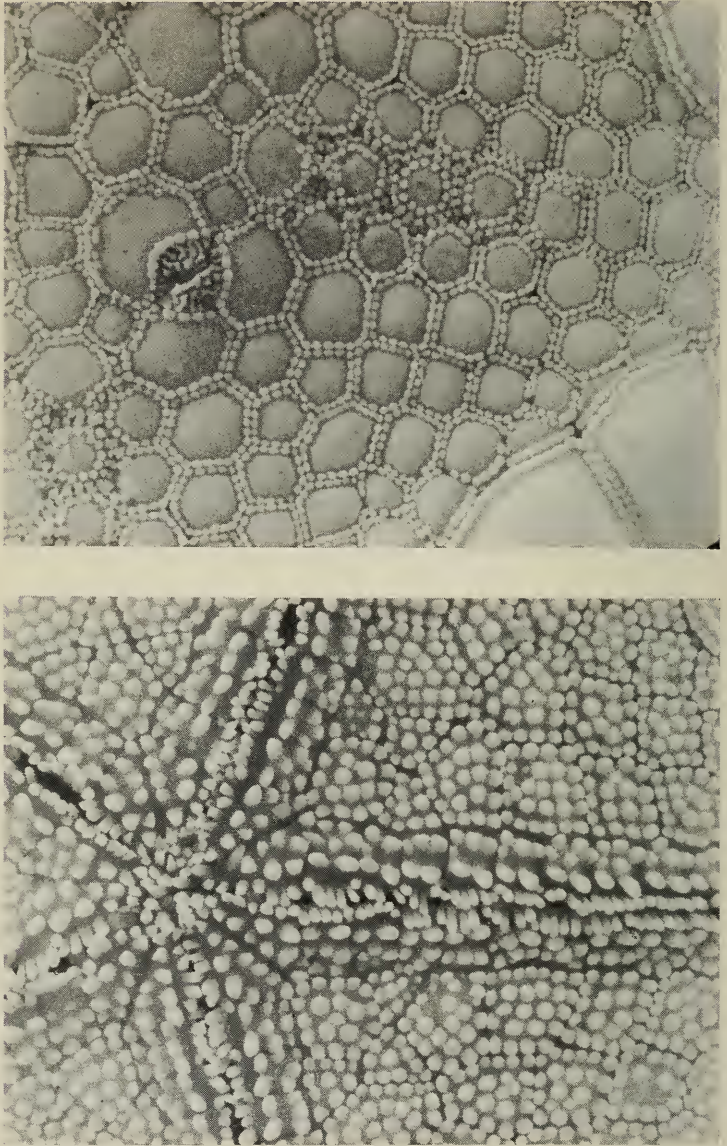


FIG. 3. *Diplasiaster productus* (A. H. Clark), specimen from R/V Pillsbury sta. 707: top, abactinal view, 8.5 \times .—bottom, actinal view, 7.3 \times .

Mouth plates relatively small. Each plate bearing eight furrow spines. First seven spines subequal, similar to adambulacral furrow spines; median spine slightly taller and stouter. Eight to ten scattered spines, grading actually into granules similar to those of actinals, covering rest of plate.

Anus subcentral, inconspicuous. Madreporite irregularly round, slightly smaller than adjacent abactinals; located approximately one-third distance from center of disk to middle of interbranchial arc.

Type: United States National Museum, cat. no. 36930.

Type-locality: 23°10'N, 82°23'W, 567 m, *Albatross* sta. 2154.

Distribution: This species is known from only two localities: off Havana, Cuba, 567 m and off the Peninsula de Paria, Venezuela, 78 m.

Apollonaster new genus

Diagnosis: Abactinal plates of radial areas covered by peripheral row of large, flattened granules and one to three additional rows of rounded granules, leaving small, naked central area. Abactinal plates of inter-radial areas, center of disk and arms covered by peripheral row of small, flattened granules and zero to two additional rows of rounded granules, leaving large, naked central area. Central naked areas smooth.

Remarks: This genus belongs in the subfamily Goniasterinae. It appears to be intermediate between *Ceramaster* and *Diplasiaster*.

Type-species: *Apollonaster yucatanensis* new genus, new species.

Etymology: Apollo—in honor of the flight of Apollo 11, which landed the first men on the moon; *aster*, Greek—a common ending for genera of sea stars.

Apollonaster yucatanensis new genus, new species

Figures 4, 5

Material studied: Holotype: R = 36 mm, r = 24 mm, R/r = 1.5; 20°57'N, 86°34'W, 40–165 m, R/V *Gerda* sta. 899, 10 September 1967, USNM E11285.

Diagnosis: Six or seven subequal, strongly compressed adambulacral furrow spines. Thirteen mouth furrow spines.

Description: Five arms. R = 36 mm, r = 24 mm, R/r = 1.5. General form arcuate pentagonal.

Abactinal plates low-tabulate. Plates of radial areas covered by peripheral row of large, flattened granules and one to three additional rows of rounded granules, leaving small, naked area in center of plate. Plates of interradial areas, center of disk and very short arms covered by peripheral row of small, flattened granules and zero to two additional rows of rounded granules, leaving large naked area in center of plates. Central naked areas smooth. Some plates bearing small, excavate sugar-tong pedicellariae.

Fourteen superomarginal and sixteen inferomarginal plates corresponding, except at tip of arm, where two inferomarginals correspond with

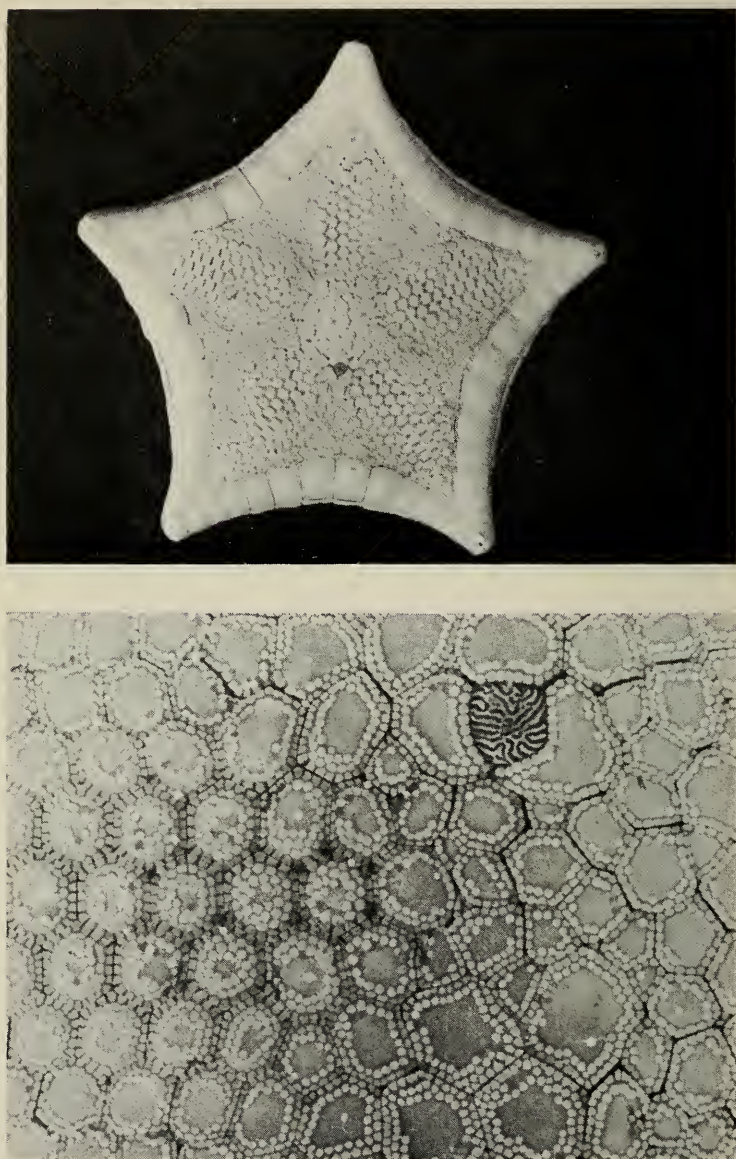


FIG. 4. *Apollonaster yucatanensis* new genus, new species, holotype, abactinal view; Top, actual size.—Bottom, 6.9 \times .

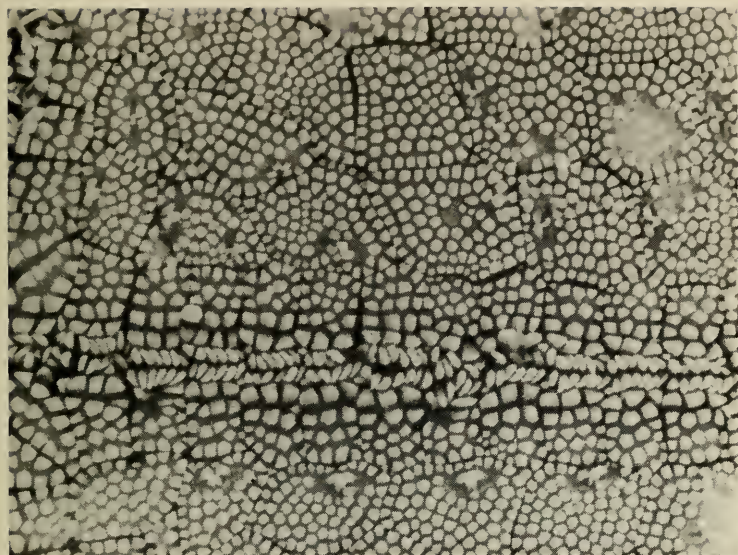


FIG. 5. *Apollonaster yucatanensis* new genus, new species, holotype, actinal view, 6.9 \times .

one superomarginal. Supermarginals slightly wider than long; surrounded by two rows of small, rounded granules, with several similar granules scattered about center. Some plates bearing small, excavate sugar-tong pedicellariae like those on abactinals. Terminal plate very small, oval. Infermarginals slightly wider than long; surrounded by three to seven rows of small, rounded granules like those of supermarginals; several similar granules scattered about center of plate. Some plates bearing small, excavate sugar-tong pedicellariae.

Actinal plates large, rhombic, completely covered by moderately large, rounded granules. Some plates bearing excavate sugar-tong pedicellariae slightly larger than those on abactinals.

Adambulacral plates rectangular (about twice as wide as long) with straight furrow margin bearing six or seven subequal, strongly compressed furrow spines. First subambulacral row of three or four large, prismatic granules. Three or four more irregular subambulacral rows of three to five granules similar to those on actinals. Some plates bearing excavate sugar-tong pedicellariae.

Mouth plates long, narrow. Each plate bearing thirteen subequal furrow spines, similar to those on adambulacrals; median spine slightly enlarged. Rest of plate covered by 20–25 prismatic granules grading actinally into granules similar to those of actinals.

Madreporite irregularly round, about same size as adjacent abactinals;

located approximately one-quarter distance from center of disk to middle of interbrachial arc.

Type: United States National Museum cat. no. E11285.

Type-locality: Arrowsmith Bank, Yucatan, 20°57'N, 86°34'W, R/V *Gerda* sta. 899.

Remarks: The naked areas of the abactinal plates are not due to the granules being rubbed off. The granules are set in small, hemispherical pits in the plate which are readily apparent when the granules are rubbed off.

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